International Journal of Agricultural Science and Research (IJASR)
ISSN(P): 2250-0057; ISSN(E): 2321-0087
Vol. 6, Issue 4, Aug 2016, 111-118

SUCCESSION OF MAJOR INSECT PESTS IN OKRA, *ABELMOSCHUS ESCULENTUS* (L.) MOENCH GROWN IN SUMMER

NAZIYA P. PATHAN & T. M. BHARPODA

Department of Entomology, B. A. Collage of Agriculture, Anand Agricultural University, Anand, Gujarat, India

ABSTRACT

The incidence of whitefly remained low throughout season during summer, 2015. The population aphid showed highly significant negative association with Bright Sunshine Hours (BSS) (r = -0.72**). The higher activity of mite was recorded during 4th week of May. Temperature (minimum, MinT and maximum, MaxT), BSS and Wind Speed (WS) were the important abiotic factors affected the fluctuation of mite population. The activity of Earias vittella Fab. as fruit borer was highly correlated with BSS (0.83**), WS (0.74**), MaxT (0.79**) and MinT (0.85**). Spiders, universal predator showed significant positive association with MaxT (0.59*) and MinT (0.72**). Correlation study between/among various insect pests indicated that aphid had significant association with the activity of leafhopper (r = 0.60*). Whereas, E. vittella showed highly significant positive association with mite (0.74**).

KEYWORDS: Aphid, Whitefly, Mite, E. vittella, Spiders, Leafhopper

Received: Jun 20, 2016; **Accepted:** Jul 13, 2016; **Published:** Jul 14, 2016; **Paper Id.:** IJASRAUG201616

Original Article

INTRODUCTION

Okra (*Abelmoschus esculentus* L. Moench) is the only vegetable crop of significance in the Malvaceae family. As many as 72 insect species have been recorded on okra (Pal *et al*., 2013). The major insect-pests infesting okra are shoot and fruit borer, *Earias vittella* (Fabricius); leafhopper, *Amrasca biguttula biguttula* Ishida; aphid, *Aphis gossypii* Glover; whitefly, *Bemisia tabaci* Gennadius; fruit borer, *Helicoverpa armigera* (Hubner) Hardwick; weevil, *Myllocerus* spp.; semilooper, *Anomis flava* Fabricius; red spider mite, *Tetranychus cinnabarinus* Boisduval; thrips, *Thrips tabaci* Lindeman; mealybug, *Ferrisia virgata* Cockrell and scale insect, *Saissetia coffeae* Walker. In order to study the instantaneous effect of weather parameters on population fluctuation of various pests, the data of physical factors of environment *viz.*, bright sunshine (BSS), rainfall (RF), wind speed (WS), maximum (MaxT) and minimum (MinT) temperature, morning (RH_1) and evening (RH_2) relative humidity were correlated. Week-wise data on various parameters were also recorded. When more than one insect pests from the different category occurred, the management strategy become rather difficult. In addition, there may be some relationship between or among the insect pests in nature. The management strategies for the insect pests can become sound and economically viable when the information on pest succession is integrated in to it. Therefore, present experiment was carried out at Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand during summer, 2015.

MATERIALS AND METHODS

The whole experimental plot (15 × 10 m; having okra variety: Gujarat Anand Okra-5) was divided into four equal sectors and ten plants were selected randomly from each sector for recording the observations. The whole experimental plot was kept free from any insecticides application.

Method of Recording Major Insect Pests

Observations on leafhopper, *A. biguttula*; aphid, *A. gossypii*; and whitefly, *B. tabaci* population were counted from three (upper, middle and lower) leaves whereas; mite, *T. cinnabarinus* population was recorded from the same leaves of 4 cm^2 area of the same selected plants in each sector. Shoot and fruit damage due to shoot and fruit borer [*E. vittella*] was also worked out.

Correlation Study

In order to study the instantaneous effect of weather parameters on population fluctuation of various pests, the data of physical factors of environment *viz.*, bright sunshine (BSS), rainfall (RF), wind speed (WS), maximum (MaxT) and minimum (MinT) temperature, morning (RH_1) and evening (RH_2) relative humidity were correlated.

In order to determine the succession of insect pests and their natural enemies, the periodic mean incidence of the major insect pests and their natural enemies were worked out. Simple correlation was worked out between various pests and their natural enemies using their weekly mean incidence by adopting a standard statistical procedure (Steel and Torrie, 1980).

RESULTS AND DISCUSSIONS

Summer, 2015

Leafhopper, *A. biguttula biguttula*

Occurrence

The incidence of leafhopper commenced in okra crop *i.e.*1st week of March (10th Standard Meteorological Week-SMW, 1st Week After Germination-WAG) during summer, 2015 (Table 1 and Figure 1). The activity of leafhopper was notice from 1st week of March and remained throughout the crop season. The number of leafhopper per three leaves ranged from 0.43 to 7.45 with mean population of 3.79. The leafhopper population gradually increased from 3rd week of March (12th SMW, 3rd WAG) and reached to first peak (7.45) during 4th week of March (13th SMW, 4th WAG). It decreased and again flared back during 4th week of April (17th SMW, 8th WAG) with its second peak (5.18). The decreasing trend was observed during 1st, 2nd, 3rd and 4th week of May (18th, 19th, 20th and 21st SMW; 9th, 10th, 11th and 12th WAG, respectively).

Effect of Weather Parameters

The data presented in Table 2 revealed that there was no significant impact of all the physical factors under study on the incidence of leafhopper population. BSS, RF, WS, RH_1 and RH_2 showed negative correlation. Rest of the abiotic parameters *i.e.* MaxT and MinT had positive impact on the fluctuation of leafhopper population.

The present findings on occurrence of leafhopper was in close agreement with the findings of Mohansundaram and Sharma (2011). Nath *et al*. (2011) highlighted the non-significant association of abiotic factors on activity of leafhopper. Mari (2013) reported that the infestations of leafhopper was started at one month after germination and

continued until harvesting of okra crop in Pakistan. However, there was slight deviation in appearance of leafhopper in present study, might be due to different locations.

Aphid *A. gossypii*

Occurrence

Data on population of aphid recorded at weekly interval during summer, 2015 presented in Table 1 and depicted in Figure 1 clearly indicated that there was low and sporadic incidence of aphid and it was observed only during 2nd week of March (0.03 aphids/3 leaves), 4th week of March (2.68), 1st week of April (1.35) and 2nd week of April (0.03). The population ceased off after 2nd week of April (15th SMW, 6th WAG).

Table 1: Population of Major Insect Pests and Natural Enemies in Okra Crop during Summer, 2015

Month /Week	SMW	WAG	No. of sucking pests/3 leaves				Damage (%) fruits due to *E. vittella*	Natural enemies/plant	
			Leaf hopper	Aphid	Whitefly	Mite		Coccinellids (Grubs + Adults)	Spiders
March -I	10	1	0.43	0.00	0.00	0.00	0.00	0.00	0.00
II	11	2	0.90	0.03	0.00	0.00	0.00	0.00	0.00
III	12	3	4.15	0.00	0.00	0.00	0.00	0.00	0.00
IV	13	4	7.45	2.68	0.00	0.00	0.00	0.00	0.00
April - I	14	5	4.38	1.35	0.00	0.00	0.00	0.15	0.18
II	15	6	3.65	0.03	0.23	0.00	0.00	0.03	0.13
III	16	7	4.85	0.00	0.43	0.00	19.65	0.00	0.13
IV	17	8	5.18	0.00	0.10	0.35	34.14	0.00	0.13
May – I	18	9	4.95	0.00	0.00	2.95	37.19	0.00	0.15
II	19	10	3.88	0.00	0.00	5.00	36.68	0.00	0.25
III	20	11	3.18	0.00	0.00	9.65	36.37	0.00	0.23
IV	21	12	2.53	0.00	0.00	10.40	39.28	0.00	0.08
Mean ± SE			**3.79 ± 0.55**	**0.34 ± 0.24**	**0.06 ± 0.04**	**2.36 ± 1.13**	**16.94 ± 2.29**	-	**0.10 ± 0.03**

Note: WAG = Week after Germination; SMW = Standard Meteorological Week; No. of observations (n) = 12
Mite recorded from 4 cm^2 area

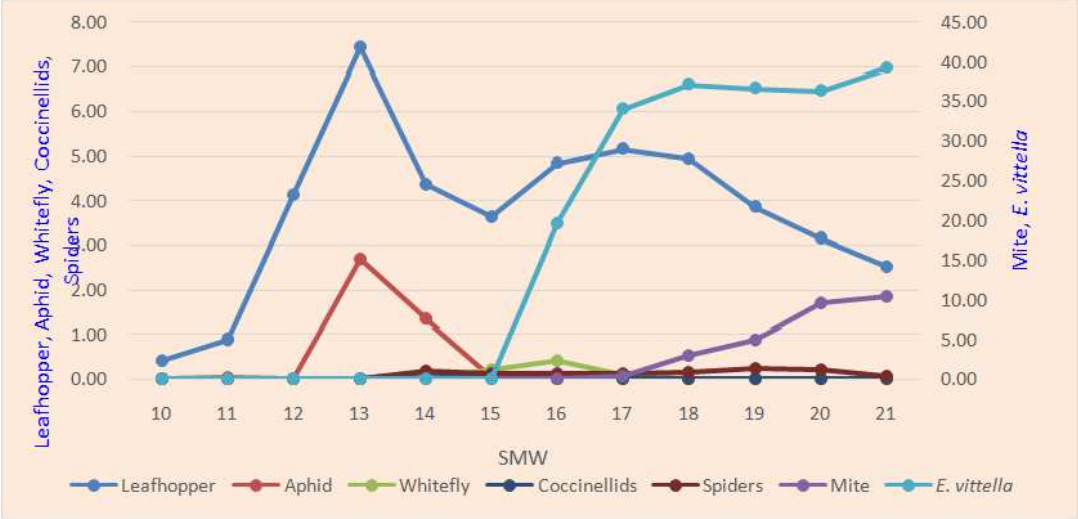

Figure 1: Population of Major Insect Pests and Natural Enemies in Okra during Summer, 2015

Table 2: Correlation Coefficient (R) between Insect Pests Infesting Okra Crop and Weather Parameters During Summer, 2015

Weather Parameters	Sucking pests				Damage (%) fruits due to *E. vittella*	Spiders
	Leafhopper	Aphid	Whitefly	Mite		
Bright Sunshine, hr/day (BSS)	-0.14	-0.72**	0.04	0.66*	0.83**	0.47
Rainfall mm (RF)	-0.12	-0.14	0.36	-0.23	-0.35	0.00
Wind Speed, km/hr (WS)	-0.10	-0.20	-0.25	0.83**	0.74**	0.42
Maximum Temperature, ^{0}C (MaxT)	0.55	-0.05	0.08	0.63*	0.79**	0.59*
Minimum Temperature, ^{0}C (MinT)	0.37	-0.01	0.07	0.77**	0.85**	0.72**
Morning Relative Humidity, % (RH_1)	-0.07	0.03	0.07	-0.44	-0.29	-0.29
Evening Relative Humidity, % (RH_2)	-0.29	0.21	-0.18	-0.08	-0.35	-0.15

Note: * Correlation is significant at 0.05 level; ** Correlation is significant at 0.01 level. Mite recorded from 4 cm^2 area

Effect of Weather Parameters

The data presented in Table 2 clearly indicated that all the weather parameters understudy fail to exert the pressure on activity of aphid during summer, 2015; except BSS (r = -0.72**). The abiotic factor *viz.*, WS, RF, MaxT and MinT showed negative correlation while RH_1 and RH_2 had positive correlation with aphids. Pal *et al.* (2013) reported lower population of aphid in okra. In present investigations, the activity of this pest was also lower and sporadic.

Whitefly, *B. tabaci*

Occurrence

There was no incidence of whitefly in the okra crop up to 1st week of April (14th SMW, 5th WAG) during summer, 2015 (Table 1 and Figure 1) and it was appeared and remained on the crop during 2nd (6th WAG), 3rd (7th WAG) and 4th (8th WAG) week of April that is 15th, 16th and 17th SMW, respectively.

Effect of Weather Parameters

There was no significant association between abiotic factors and population of whitefly (Table 2). However, BSS, RF, MaxT, MinT and RH_1 showed positive correlation whereas; WS and RH_2 had negative association with the pest activity.

Looking to the past findings; Ahmad *et al.* (2010), Mohansundaram and Sharma (2011), Nath *et al.* (2011), Patel *et al.* (2012), Soomro *et al.* (2012), Singh *et al.* (2013) and Pal *et al*. (2013) reported the activity of whitefly in okra low to high during the crop season. In fact, the activity of this pest was remained very low during the crop periods in the present investigation. The lower population of whitefly during summer seasons might be due to the various abiotic factors. Physical factors prevailing during the crop season did not support to the pest activity as correlation study was found non-significant. Above referred workers also stated that some of the abiotic factors exerted significant impact on the incidence of the pest. In present investigation, none of the abiotic factors showed significant role on the pest activity. Non-significant findings emerged out from the present investigation is matched with the findings of the Nath *et al.* (2011).

Red Spider Mite, *T. cinnabarinus*

Occurrence

The data (Table 1 and Figure 1) revealed that there was no incidence of mite in okra crop up to 3rd week of April (16th SMW, 7th WAG). The population of mite started during later crop growth stage *i.e.* 4th week of April (17th SMW, 8th WAG) and steadily increased and reached on peak (10.40 mites/3 leaves) at maturity stage *i.e.* 4th week of May (21st SMW, 12th WAG) with mean population 2.36 ± 1.13. Overall, mite activity was observed nearer to the crop maturity *i.e.* later part of crop.

Effect of Weather Parameters

Correlation study between physical factors of the environment with the activity of mite (Table 2) indicated significant positive association of BSS (r = 0.66*) and MaxT (0.63*) and highly significant positive correlation as in case of WS (0.83**) and MinT (0.77**) with population fluctuation of mites. Relative humidity and rainfall did not show significant impact on the pest.

The present finding on late occurrence of pest is matched with the finding of Kapoor *et al.* (2000). Further, MaxT and MinT showed highly significant positive and negative, respectively associated with the activity of pest under present study which was more or less similar with the finding of Nath *et al*. (2011).

Shoot and Fruit borer, *E. vittella*

Occurrence

The data (Table 1 and Figure 1) revealed that *E. vittella* infestation in okra fruits was started from 3rd week of

April (16th SMW) (19.65%) and remained up to harvest of okra crop *i.e.* 4th week of May (21st SMW, 12th WAG with a mean 16.94 ± 2.29 per cent). The percent damage was in range of 19.65 to 39.28 with the mean of 16.94.

Effect of Weather Parameters

The study on the effect of abiotic factors on shoot and fruit borer (*E. vittella*) presented in Table 2 revealed that BSS (r = 0.83**), WS (0.74**), MaxT (0.79**) and MinT (0.85**) showed highly positive significant association with fruit damage caused by *E. vittella*. Other weather parameters did not exert any significant impact on the pest.

Pal *et al*. (2013) stated the activity of this pest and attained maximum level during 16th SMW. Thus, the present findings are in agreement with the earlier reports.

Activity of Various Natural Enemies in Okra

The activity of natural enemy's *viz.* spiders and coccinellids was also studied during summer, 2015.

Coccinellids (Grub + Adults)

Occurrence

The data presented in Table 1 and depicted in Figure 1 indicated that the population of coccinellids was observed on crop during 1st (14th SMW, 5th WAG) and 2nd (15th SMW, 6th WAG) week of April (0.15 and 0.03 coccinellid adults/plant, respectively). The population of coccinellids disappeared from the crop later on.

Spiders

Occurrence

The data presented in Table 1 and depicted in Figure 1 indicated that the population of spiders started to appear on crop during 1st week of April (14th SMW, 5th WAG). The population of spiders ranged from 0.08 to 0.25 per plant with average population of 0.10. The peak activity (0.25 spiders/plant) was observed during 2nd week of May (19th SMW, 10th WAG).

Effect of Weather Parameter

Based on the results (Table 2) of summer, 2015; it is clearly indicated that MaxT (r = 0.59*) had significant positive correlation while MinT (0.72**) exerted highly significant positive association with population fluctuation of spiders.

Association between/among Insect Pests in Okra (Pest Succession)

The results of correlation study (Table 3) between/among various insect pests of okra indicated that aphid had significant association with the activity of leafhopper (r = 0.60*). Whereas, *E. vittella* showed highly significant positive association with mite (0.74**).

Scanty information was available on the association between/among various insect pests as well as their natural enemies as far as okra crop is concerned. However, Deb (2014) reported positive association among the insect pests of tomato. Patel (2014) also reported from Navsari (Gujarat) that aphid, leafhopper, whitefly, mite and *E. vittella* were found significant or non-significant but positively correlated with each other during summer.

SUMMARY AND CONCLUSIONS

Activity of leafhopper was noticed from 1st week of March with two peaks. Aphid appeared during 2nd week of March (11th SMW) (0.03/ 3 leaves) with the highest activity (2.68) during 4th week of March. There was highly significant negative association of BSS (r = -0.72**) with the activity of aphid. The incidence of whitefly was minimal throughout the crop season. Population of mite was started during 4th week of April (17th SMW) and reached on peak during 4th week of May (21st SMW) (10.40 per 3 leaves). Significant positive association of BSS (0.66*), MaxT (0.63*), WS (0.83**) and MinT (0.77**) was established with the activity of mites. Fruit damage due to *E. vittella* was commenced from 3rd week of April (16th SMW) (19.65%) and ranged from 19.65 to 39.28 per cent fruit damage. BSS (0.83**), WS (0.74**), MaxT (0.79**) and MinT (0.85**) showed highly significant positive association with fruit damage caused by *E. vittella*. Spiders was started from the 1st week of April (14th SMW) with the ranged from 0.08 to 0.25 per plant. MaxT (r = 0.59*) and MinT (0.72**) found significant positive association with the activity of spiders. The coccinellids was observed only during 1st (14th SMW) and 2nd (15th SMW) week of April as 0.15 and 0.03 coccinellids per plant, respectively. Looking to the pest succession, during summer, 2015; aphid revealed significant association with leafhopper (0.60*). Whereas, *E. vittella* showed highly significant association with mite (0.74**).

Table 3: Correlation Coefficient (R) Between Major Insect Pests and Natural Enemies in Okra Crop During Summer, 2015

Insect Pests	No. of Sucking Pests/ 3 Leaves				Damage (%) Fruits due to *E. vittella*	Natural Enemies/Plant	
	Leaf Hopper	Aphid	Whitefly	Mite		Coccinellids	Spiders
Leafhopper	-	-	-	-	-	-	-
Aphid	0.60*	-	-	-	-	-	-
Whitefly	0.20	-0.21	-	-	-	-	-
Mite	-0.18	-0.27	-0.30	-	-	-	-
E. vittella	0.11	-0.41	-0.04	0.74**	-	-	-
Coccinellids	0.09	0.36	-0.08	-0.22	-0.34	-	-
Spiders	0.19	-0.23	0.12	0.45	0.63	0.26	-

Note: * Correlation is significant at 0.05 level; ** Correlation is significant at 0.01 level. Mite recorded from 4 cm^2 area

REFERENCES

1. *Ahmad, S.; Bhagat, R. M.; Ishtiyaqahad and Kumar, A. (2010). Pest complex & their succession on okra Abelmoschus esculentus L. Moench. Haryana Journal of Horticultural Science,* ***39*** *(1&2): 169-171.*
2. *Deb, S. (2014). Succession of insect pest, life table and management of fruit borer, Helicoverpa armigera (Hubner) Hardwick in tomato. Ph. D. Thesis submitted to AAU, Anand.*
3. *Kapoor, V. C. R.; Manmeet, B. B. and Mahal, M. S. (2000). Population dynamics of mite associated with okra (Hibiscus esculentus) and brinjal (Solanum melongena) in Punjab. Indian Journal Agricultural Science,* ***67*** *(7): 325-326.*
4. *Mari, J. M. (2013). Impact of trap crops on the population of jassid (Amrasca devastans (dist.) in okra. Wudpecker Journal of Agricultural Research,* ***2*** *(9): 252 – 255.*
5. *Mohansundaram, A. and Sharma, R. K. (2011). Abundance of pest complex of okra in relation to abiotic and biotic factors. Ann. Pl. Protec. Sci.,* ***19*** *(2): 286-290.*

6. *Nath, L.; Prasad C. S.; Tiwari, G. N. and Kumar, A. (2011). Impact of weather parameters on major insect pests of okra prevailing western Uttar Pradesh. Vegetos – An International Journal of Plant Research,* ***24*** *(2): 152-156.*

7. *Pal, S.; Maji, T. B. and Mondal, P. (2013). Incidence of insect pest on okra Abelmoschus esculentus (L) Moench in red lateritic zone of West Bengal, Journal of Plant Protection Sciences,* ***5*** *(1): 59-64.*

8. *Patel, K. B.; Patel, M. B. and Patel, K. M. (2012). Succession of important insect pest of okra under south Gujarat condition. Agres- An International e-Journal,* ***1*** *(3): 328-333.*

9. *Patel, P. B. (2014). Succession of pests and eco-friendly management of red spider mite (Tetranychus urticae Koch) in summer okra. Ph. D. Thesis submitted to AAU, Anand.*

10. *Singh, Y.; Jha, A.; Verma, S.; Misra, V. K. and Singh, S. S. (2013). Population dynamics of sucking insect pests and its natural enemies on okra agro-ecosystem in Chitrakoot region. African Journal of Agricultural Research,* ***8*** *(28): 3814-3819.*

11. *Soomro, H. S.; Sultana, R.; Soomro, A. H.; Solangi, B. K. and Solangi, M. N. (2012). Studies on the distribution pattern of whitefly Bemisia tabaci Genn. on okra crop in Sindh-Pakistan. Pakistan Journal of Entomology Karachi,* ***27*** *(2): 111-116.*

12. *Steel, R. G. D. and Torrie, J. H. (1980). Principles and procedures of statistics. Publ. McGraw-Hill Book Company, New York, pp. 137.*